Distal septic emboli and fatal brachiocephalic artery mycotic pseudoaneurysm as a complication of stenting

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The use of percutaneous angioplasty with subsequent intravascular metallic stent placement has gained increasing acceptance over the past decade. Infections of these stents appear to be uncommon; however, the rarity of this complication may in part be the result of a lack of availability of long-term follow-up data. A number of examples of infected cardiac and peripheral vascular stents have been reported, often with fatal consequences. Herein, we report a 74-year-old woman who underwent subclavian and brachiocephalic artery angioplasty and stent placement for symptomatic stenoses. Six months after the initial intervention, the patient returned with restenosis of the stents and underwent repeat angioplasty to restore full patency. Two weeks later, the patient was readmitted with generalized malaise and multiple erythematous, macular lesions on the right forearm and hand. Blood cultures grew *Staphylococcus aureus*, and a computed tomographic scan of the chest showed a large brachiocephalic artery pseudoaneurysm with surrounding hematoma. Despite prompt surgical intervention, this complication proved ultimately fatal. Infections of metallic endovascular stents are potentially life-threatening complications and must be addressed urgently, including possible surgical intervention. (J Vasc Surg 2002;36:625-8.)

Percutaneous angioplasty with placement of intravascular metallic stents is now a widely accepted option for treatment of vascular occlusive disease. Well-known complications of these stents include intimal dissection, thrombosis, and malpositioning.[1,2] Infection is still considered a rare complication, despite an increasing number of reports describing arteritis associated with infected stents,[1-8] often with fatal outcome from rupture of the affected vessel caused by pseudoaneurysm formation around the infected foreign body. Although most reports conclude with a recommendation for prophylactic antibiotics at the time of the initial procedure and for any later endovascular manipulations, this practice is still not widely accepted. Herein is reported the case of a patient in whom an infection developed associated with brachiocephalic and subclavian artery metallic stents after repeat angioplasty, with an ultimately fatal outcome despite aggressive medical and surgical interventions.

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CASE REPORT

A 74-year-old woman was seen in January 2001 with 3 weeks of progressive pain and discoloration in the right hand, with the right index finger having turned black. Medical history was notable for a 50 pack-year history of smoking but no known prior history of peripheral vascular disease. On physical examination, the patient was found to have a mummified right index finger with only a weakly audible right radial artery Doppler signal. Arteriography showed a 75% stenosis of the proximal right subclavian artery, with a 30% stenosis more distally (Fig 1 , *A*). In addition, a 65% stenosis was noted in the brachiocephalic artery at its origin from the aortic arch, and the right radial artery was occluded. Tandem 10 × 40 mm Smart stents were placed successfully via the left femoral artery into the subclavian stenoses, and a Palmaz 294 stent was placed into the brachiocephalic artery at its origin. Completion arteriography confirmed optimal positioning of the stents with restoration of blood flow. The patient underwent amputation of the distal phalanx of the right index finger 2 days later. The patient recovered promptly and was discharged home in stable condition on clopidogrel bisulfate and aspirin therapy with a strong recommendation to discontinue smoking.

In July 2001, the patient returned with new ischemic symptoms of the right third finger, which was erythematous with blistering. The patient had continued smoking and had neglected to take the antiplatelet medications. Angiography showed severe restenosis, presumably from intimal hyperplasia, in the stented brachiocephalic and right subclavian arteries (Fig 1 , *B*). Repeat balloon angioplasty was performed with marked improvement in blood flow. The patient was again placed on aspirin and clopidogrel bisulfate therapy and was discharged in stable condition. Of note, no antibiotics were used during either angiographic procedure, which is standard protocol for stent placement at our institution.

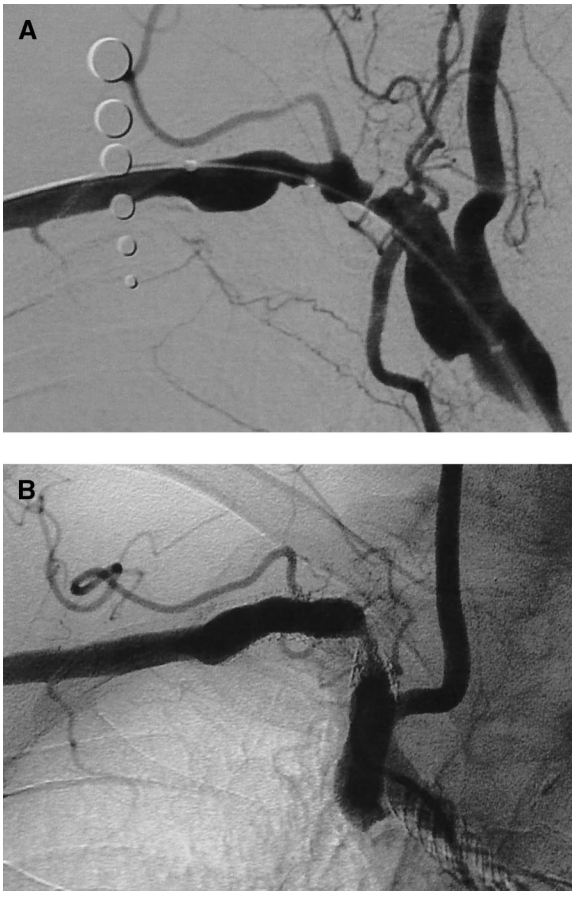

Fig 1. A, Arteriogram from January 2001 shows 75% stenosis of proximal right subclavian artery, with 30% stenosis more distally and 65% stenosis in brachiocephalic artery at its origin from aortic arch. **B,** Arteriogram from July 2001 shows restenosis of tandem 10 × 40 mm Smart stents in subclavian artery and Palmaz 294 stent in brachiocephalic artery at its origin.

Two weeks later, the patient had generalized weakness and malaise, along with pain, redness, and swelling of the right hand. The patient was first admitted to a neighboring hospital where blood cultures grew *Staphylococcus aureus.* Vancomycin hydrochloride therapy was begun, and the patient was transferred to our institution. Physical examination showed petechiae consistent with septic emboli throughout the palm of the right hand and forearm, which were swollen and inflamed. The infectious disease consultant recommended intravenous nafcillin sodium therapy after sensitivities were confirmed. The condition of the hand improved rapidly on antibiotics, but the blood cultures remained positive for *S aureus* and it was recommended that the patient remain on intravenous nafcillin sodium therapy for 6 weeks.

At the time of admission, the patient had also had sudden, persistent loss of vision in the right eye. Examination with neuroophthalmology detected Roth's spots in the right eye; magnetic resonance imaging/angiography of the brain showed a punctate focus of increased signal intensity within the right corona radiata, consistent with an acute small vessel infarct. A computed tomographic (CT) angiogram showed a 60% stenosis of the right proximal internal carotid artery, 70% stenosis of the left internal carotid artery at the bifurcation, and 50% stenosis of the left vertebral artery at the origin. A thrombus was visualized between the tandem stents in the right subclavian artery, for which the patient underwent systemic anticoagulation therapy with heparin. Carotid duplex scan showed significant plaques in the left and right distal common carotid arteries extending into the internal carotid arteries, with velocities corresponding to 80% to 99% stenoses bilaterally. Although thought indicated, carotid endarterectomy was deferred until the infection cleared. After further work-up for other sources of septic emboli including echocardiography, it was ultimately decided that the visual symptoms were caused by septic embolization from the brachiocephalic stent to the brain and right eye, in addition to those to the right hand. The patient was discharged on intravenous antibiotics and anticoagulation therapy to a rehabilitation facility.

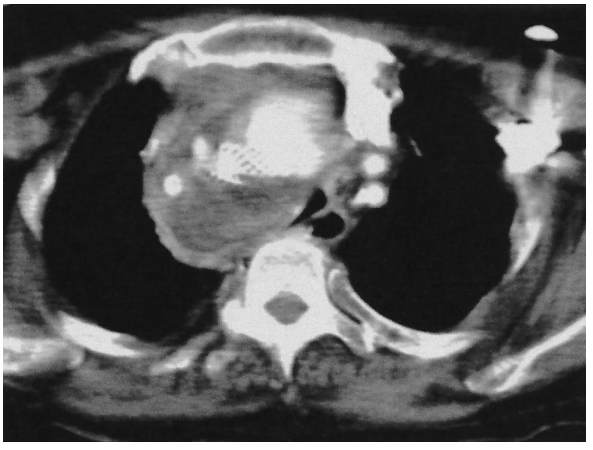

Fig 2. CT scan of chest reveals large, ill-defined homogeneous mass measuring 5 × 3 cm adjacent to right brachiocephalic artery stent descending into anterior mediastinum consistent with mycotic aneurysm with surrounding hematoma.

The patient was readmitted 1 day later after a 10-point fall in hematocrit and after stools were reportedly positive for occult blood in the rehabilitation facility, which was not duplicated on admission. While the patient was undergoing an anemia work-up, progressively worsening stridor developed. A chest radiograph showed tracheal deviation to the left, and fiberoptic direct laryngoscopy showed a paralyzed vocal cord. CT scan of the neck and chest revealed a large, ill-defined homogeneous mass measuring 5 × 3 cm adjacent to the right brachiocephalic artery stent descending into the anterior mediastinum consistent with a mycotic aneurysm with surrounding hematoma (Fig 2). Immediate operative removal of the infected stent with reconstruction was undertaken.

During an approximately 12-hour procedure in which the patient was placed on cardiopulmonary bypass and cooled to approximately 18° C, the infected, aneurysmal area of the brachiocephalic at its origin from the aorta was located. A hole 3 cm in diameter was present, through which the free-floating stent was easily removed (Fig 3). Despite efforts at reconstruction with

maintenance of adequate cerebral perfusion, the patient became difficult to ventilate after receiving massive amounts of blood and blood products. The tissues became markedly edematous, making chest closure impossible. Acute right heart failure subsequently developed, and the patient died in the operating room.

DISCUSSION

Endovascular metallic stents are being used with increasing frequency as an alternative to open operative intervention for vascular disease. Generally, infection of the artery in association with stents is considered a rare occurrence. In early multicenter trials by Palmaz et al[9] involving 587 procedures, no infections were documented, and Myles et al[3] have reported an estimated incidence rate of less than one in 10,000 cases. Reports of infectious complications of stents in the iliac, renal, subclavian, and coronary arteries and central veins have been surfacing recently, often with fatal consequences.[1-8] Iliac artery stents seem to have the highest rate of infection,[3] with access via the femoral artery the most common route of entry for placement. Possible contributory factors to infection of stents include prolonged femoral access (specifically, the sheath left in place overnight for follow-up angiography), repeated access or manipulation, or another source of coincident bacteremia, such as an infected intravenous site.[1,4] *S aureus* is by far the most common offending agent,[1,2,4-8,10] with *Staphyloccocus epidermidis* and *Pseudomonas aeruginosa* occurring much less often. Patient presentation characteristically involves fever, leukocytosis, and bacteremia, with occasional septic petechiae in the involved extremity or a focal painful mass associated with a pseudoaneurysm, and rarely limb ischemia.[4] These symptoms generally present within 1 to 2 weeks after initial placement of the stents, suggesting contamination of the stent during its initial placement, or after repeat intravascular manipulation, as in the case presented herein. Initial treatment includes intravenous antibiotics, preferably vancomycin hydrochloride, until sensitivities return. Usually, the *S aureus* is pansensitive, and the patient is converted to intravenous nafcillin sodium therapy for an average course of 6 weeks. Reports vary concerning administration of extended oral antibiotic coverage after treatment of the acute infection, as do recommendations regarding the frequency of follow-up studies, such as serial imaging with CT scans or angiography when mycotic pseudoaneurysms or true aneurysms have developed.[3]

Treatment for this potentially devastating condition has not yet been standardized. It remains unclear when to pursue conservative medical therapy with intravenous antibiotics versus surgical intervention for removal of the infected hardware and vascular reconstruction. Several reports[2,3,5] describe successful treatment with resolution of *S aureus* bacteremia with antibiotic therapy alone. However, other contributors describe formation of mycotic pseudoaneurysms with subsequent fatal rupture,[2,4,6] encouraging a more aggressive approach with operation earlier rather than later. As this case illustrates, even extensive surgical intervention may fail to result in survival. In general, development of a pseudoaneurysm precedes arterial rupture and should be an indication for urgent surgical repair if the condition is correctly diagnosed.

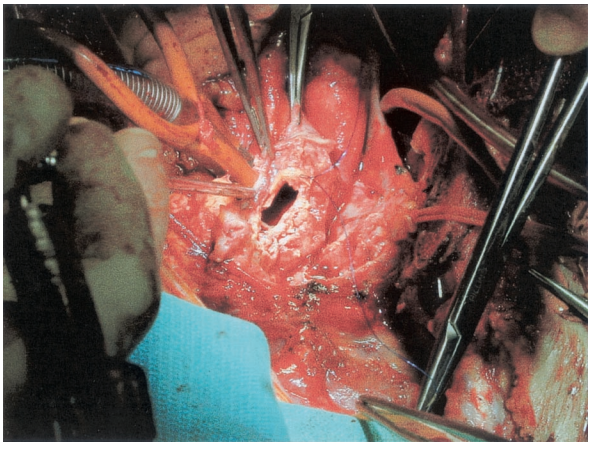

Fig 3. Intraoperative photo shows defect in aorta at takeoff of brachiocephalic artery after removal of infected pseudoaneurysm and stent.

The issue of prophylactic antibiotics also remains open to debate. Although Myles et al[3] suggest that the prevalence of stent-associated infections remains low enough that prophylactic antibiotics are not indicated, others who have experienced the devastating morbidity of an infectious complication would recommend antibiotics at the time of stent placement and during repeat manipulations and possibly during any procedure that may incur transient bacteremia or place the patient at higher risk (such as a sheath left in place overnight). This suggestion is supported by studies in a swine model, in which a 70% infection rate occurred when a bacterial challenge was given at the time of deployment and a 50% rate when given 28 days later.[10] This study showed that prophylactic antibiotics at the time of stent placement significantly reduce the incidence of stent infections, although it also suggested that once the stent has been incorporated, prophylactic antibiotics should not be necessary.

This case shows that placement of stents in difficult to reach locations predisposes to a more serious outcome should the stent become infected. With this in mind, the use of periprocedural prophylactic antibiotics should be highly encouraged in such situations.

In conclusion, metallic endovascular stents have the potential for infection, possibly with devastating morbidity and mortality. Prophylactic antibiotics should be used at the time of insertion, particularly when the groin will be accessed for a prolonged period or the stents are being placed in a difficult to access area. Should infection occur, intravenous antibiotics must be instituted. However, if infection is associated with mycotic aneurysm formation, surgical intervention for removal and reconstruction should be pursued promptly. Finally, serial imaging is vitally important in patients treated both medically and surgically to detect late aneurysmal formation at the site of former infection.

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